SHAFT SEAL ASSEMBLY WITH RETAINING RING AND WASHER

FIELD OF THE INVENTION

[0001] The subject invention relates to shaft seal assemblies intended for use on rotary shafts, and more particularly to a seal assembly featuring components preassembled prior to shipment to an end user to facilitate mounting and retention of the seal assembly on the shaft and relative to the bore of a shaft seal housing.

BACKGROUND OF THE INVENTION

[0002] Various seal assemblies exist in the art that are used with rotary shafts in compressors and other operating environments to seal an annual space between the shaft and a bore through which the shaft extends. Such seal assemblies are often supplied to end users with the components disassembled. Thus, the end user must reassemble the components piece-by-piece to properly reconstruct and install the seal assembly about the shaft. Such components include, but are not limited to flexible elastomeric seal members with metal carriers, retaining rings, and padded components such as washers.

[0003] The prior art assemblies typically include a flexible washer packaged separately from the other components. The separately packaged components are sold to an end user, who must then assemble the washer with the other components during installation of the same on a shaft.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0004] The invention provides a shaft seal assembly for use on a rotating shaft to be sealed. The seal assembly includes an annular carrier, a radially-acting annular shaft seal element for encircling the shaft, and an annular felt washer. The washer is fixed to the carrier such that the carrier, shaft seal element and washer are unitized.

[0005] Accordingly, the shaft seal assembly eliminates loose components — the components are supplied to the end user preassembled. Thus, parts previously given separate part numbers and supplied as separate components for an end user to interconnect before final installation or otherwise install one part at a time are now consolidated into one convenient unit prior to shipment and sale to the end user. The sealing assembly can be labeled using a single part number, shipped in a single package to the end user, and then installed in a single step using a simple push-on tool. The present invention provides a particular combination of components for a shaft seal assembly, which are unitized to promote not only cost savings, but also ease of sale, distribution and use.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0007] Figure 1 is a cross sectional view of a shaft seal assembly according to the present invention;

[0008] Figure 2 is a perspective view of the retaining ring utilized in the shaft seal assembly; and

[0009] Figure 3 is a side view of the retaining ring shown in Figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a shaft seal assembly is generally shown at **10** in Figure 1. The seal assembly **10** is shown in use within a housing **11** having a cylindrical bore **12**. The bore **12** receives a rotatable shaft **13** therethrough.

[0012] The seal assembly **10** includes an annular carrier **14**. A radially acting annular shaft seal element **16** is mounted on the carrier **14** and encircles the rotating shaft **13** to be sealed. An annular felt washer **18** is fixed to the carrier **14**, such that the carrier **14**, shaft seal element **16** and felt washer **18** are unitized. Although the washer **18** may be fixed to the carrier **14** utilizing any suitable method, the washer **18** is fixed to the carrier **14** by adhesion. Adhering the washer **18** to the carrier **14** maintains the carrier **14** wedged against the seal element **16**, and secures the seal element **16**, carrier **14** and washer **18** together as an integral unit which can be assembled prior to distribution and sale to a supplier or an end user.

[0013] The assembly **10** also includes an annular retainer **20** for retaining the shaft seal element **16** in engagement with the shaft **13**. The retainer **20** is integral with the carrier **14**, and includes an inner edge **22** and an outer edge **24**.

[0014] As is shown in Figure 1, the carrier **14** also includes inner and outer cases, **26** and **28**, respectively, that extend in axially and radially spaced relation to one another to define a recess **30** therebetween for receiving the retainer **20**. This

maintains the shaft seal element **16** in engagement with the shaft **13**. One skilled in the art will appreciate that the inner case **26** and outer case **28** may each be formed from any material rigid enough to provide underlying structural support to the shaft seal element **16**. By way of non-limiting example, the cases **26** and **28** in Figure 1 are formed from metal.

[0015] The inner case **26** has an L-shaped cross section, with a leg **32** from which a first end flange **34** extends. The outer case **28** has interior and exterior surfaces **36** and **38**, and a first end **40** from which an annular support flange **42** extends. The support flange **42** has a sinuate cross-sectional shape, which provides enhanced support to the shaft seal element **16**. The outer case **28** also has a second end **44** from which a second end flange **46** extends. The first and second end flanges **34** and **46**, respectively, define the recess **30**.

[0016] The shaft seal element **16** includes a laydown seal member **48** fabricated from polytetrafluoroethylene for axially bending to extend along the shaft **13**. The shaft seal element **16** also includes a radial lip member **50** fabricated of rubber. The lip member **50** extends in axially and radially spaced relation to the laydown seal member **48** to engage the shaft **13**.

[0017] As is shown in Figure 1, the laydown seal member **48** has a generally L-shaped cross section, with a primary leg **52** from which an interior flange **54** extends. The leg **52** is interposed between the support flange **42** and the inner case **26** so that the interior flange **54** extends toward the radial lip member **50** in dynamic sealing engagement with the shaft **13**.

[0018] Although the laydown seal member **48** shown in Figure 1 is formed from polytetrafluoroethylene, one skilled in the art will appreciate that the seal

member **48** may be formed from any suitable alternative vinyl polymer. Furthermore, while the seal member **48** may be fabricated using any suitable method, the seal member **48** shown in Figure 1 is fabricated of a polytetrafluoroethylene disk or wafer clamped between the inner and outer cases **26** and **28**, respectively, and sealed against leakage against an intervening surface **56** of a portion **58** of seal element **16**, which is interposed between the outer case **28** and the primary leg **52**.

[0019] While the lip member **50** may be formed from any suitable rubber, or elastomer, the lip member **50** shown in Figure 1 is formed from polybutadiene.

[0020] The radial lip member **50** includes a face seal **60** that extends from the first end **40** over part of the exterior surface **38** of the outer case **28**. The face seal **60** serves as a protective cushion between the outer case **28** and the bore **12**, and includes a plurality of annular ridges **62**. The ridges **62** are for static sealing engagement with the bore **12** and cooperate with the other surfaces of the assembly **10** that contact the bore **12** and shaft **13** to maintain the assembly **10** properly positioned against the shaft **13**.

[0021] The radial lip member **50** also includes a sealing portion **64** having an inner surface **66** and an outer surface **68**. The sealing portion **64** extends from the support flange **42** to a tip **70** and dynamically seals and engages the shaft **13** to control oil flow from the outer surface **68** to the inner surface **66** as the shaft **13** rotates.

[0022] A retaining portion **72** extends from the retainer **20** into the recess **30** and acts to retain the retainer **20** in engagement with the bore **12** through which the shaft **13** extends. The retaining portion **72** engages the laydown seal

member **48** and the lip member **50**. Positioning the retaining portion **72** within the recess **30** in this manner wedges the retaining portion **72** between the laydown seal member **48** and the lip member **50**.

[0023] The retainer **20** also has an inner edge **74** and an outer edge **76**. A plurality of spaced peripheral tabs **78** extend from the outer edge **76** for engaging the bore **12**. The tabs **78** are received within and engage an annular groove **80** within the bore **12**. The retaining portion **72** has a cylindrical wall **82** that extends perpendicularly from the inner edge **74** toward the lip member **50** to an interior edge **84**. A plurality of spaced spring tabs **86** extend at an acute angle "α" from the interior edge **84** into the recess **30**. Each spring tab **86** engages the laydown seal member **48**. The interior edge **84** engages the lip element **50**. This wedges the spring tabs **86** between the laydown seal member **48** and the lip member **50**.

[0024] Although not required, the washer **18** shown in Figure 1 includes an integral flange **88**. The retainer **20** is held in place against the seal element using the flange **88**. The flange **88** extends axially under the retaining portion **72** to the lip member **50**. This permits the flange **88** to engage the retaining portion **72**, which in turn maintains the retaining portion **72** wedged between the laydown seal member **48** and the lip member **50**. The flange **88** also holds the retainer **20** in place within the groove **80** after the seal assembly **10** is installed within the bore **12**. The flange **88** is held in place against the retainer **20** by adhering the cylindrical wall **82** to the flange **88**.

[0025] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced other than as specifically described within the scope of the claims. Furthermore, the

foregoing description of the preferred embodiment of the invention and the best mode for practicing the invention are provided for the purpose of illustration only and not for the purpose of limitation -- the invention being defined by the claims.